REPORT NO. 84-2-1
ALEXANDRIA FIELD OFFICE

3430
OCTOBER 1983

# NEEDLE MIDGE DAMAGE TO LOBLOLLY PINES AT THE STUART SEED ORCHARD POLLOCK, LOUISIANA, 1983

by

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*Abstract*

*Needle droop and defoliation of 84% of the ramets of the Texas loblolly geographical seed source occurred in August 1983. Of the trees showing symptoms, 68% were severely damaged. This damage was caused by midge larvae, Contarinia n. sp., found feeding underneath fascicle sheaths. A survey was conducted on every 5th row in the Texas loblolly. The survey indicated that 90% of the clones were classified as moderately or heavily damaged. Clones 7, 8, 13, 14, and 50 showed little damage indicating resistance to damage caused by this species of midge.*

*The population in late August was concentrated in the last growth flush of the 1983 season. Approximately 95% of the fascicles within the new growth were infested and the infested fascicles contained a mean of 14.48 larvae per fascicle. A parasitic mite, Pyemotes emarginatus (Cross, Moser, Rack 1981), was found associated with 13% of the infested fascicles.*

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## INTRODUCTION

Needle droop and defoliation of loblolly pine, Pinus taeda L., caused by a Contarinia sp. of midge was first detected in September, 1971, at the USDA-FS Erambert Seed Orchard, Brooklyn, Mississippi (Overgaard et al. 1976). This infestation declined during the subsequent years and by 1976 little defoliation was observed. After 1976, loblolly defoliation caused by midge feeding has not been reported.

In early August 1983 seed orchard personnel at the USDA-FS Stuart Seed Orchard, Pollock, Louisiana, noticed the wilting condition of many of the loblolly trees. By August 17 the condition had worsened and Forest Pest Management (FPM) was contacted. It was determined that the needle droop and defoliation was caused by midges feeding on the needle tissue within the fascicle sheath. The damaged areas become visible after the needles elongate.

The species was identified as a new species of Contarinia by R. J. Gagne, USDA, ARS, Systematic Entomology Laboratory. Several related species of Contarinia apparently have similar feeding habits on other species of pines in the U.S. and Europe (DeBoo, et al. 1973, Skuhravy 1973, Gagne and Beavers, in Press).

## METHODS

On August 22 and 23, 1983, FPM conducted a survey to determine the extent of midge damage and the identity of resistant clones. The survey was conducted in the Texas loblolly and 100% of the trees in every 5th row were examined. These rows were selected to correspond to rows surveyed for the presence of shoot dieback caused by pitch canker. Damage for each tree examined was categorized as:

None - No defoliation or evidence of midge damage
Light to moderate - 0-50% of the crown showing damage and defoliation
Heavy - Greater than 50% of the crown showing damage and defoliation.

Samples of previous growth flushes which contained fully elongated needles were no longer infested with live larvae. In order to determine if the last growth flush (needles 1/3-1/2 full size) was infested, a sampling scheme was devised to sample actively growing shoots from susceptible clones. Clones 5, 18, 20, 30, 43, and 45 were selected. Ten shoots of new growth were removed from each of 2 ramets of each of the 6 sample clones. Five shoots were randomly selected from each ramet. Each shoot was divided into 1 inch segments. Five fascicles were selected from each of the 5 segments located in the most distal position on each shoot. The fascicle sheath was removed and the number of larvae per fascicle and the number of parasitic mites were recorded.

A follow-up evaluation was conducted on August 31 and September 1 (1 week subsequent to first evaluation). Four different ramets of 3 of the 5 clones originally sampled were selected for the follow-up evaluation.

Five shoots of new growth were selected and 5 fascicles per shoot were removed for examination. Total numbers of live larvae and dead larvae were recorded.

A series of slides was made from specimens collected on August 23. Additional larvae were confined in soil where pupation and adult emergence is expected to occur. These specimens were sent to R. J. Gagne for identification.

## RESULTS

Results of the midge damage survey conducted in the Texas loblolly are summarized in table 1. The clones are ranked with the most susceptible clones listed first. Clones 7, 8, 13, 14, and 50 are not listed because more than 50% of the ramets surveyed were in the "No Damage" classification. Apparently, these clones are resistant to pine needle midge damage. Needle droop and defoliation occurred on 84% of the ramets surveyed. Sixty-eight percent of these infested trees are in the severe damage classification. Clones 10, 27, 30, and 46 appear to be extremely susceptible to pine needle midge damage with 100% of the ramets surveyed in the heavy damage classification.

The midge population in late August was concentrated in the last growth flush of the 1983 season. Approximately 95% of the fascicles within the new growth were infested, and the infested fascicles contained a mean of 14.48 larvae per fascicle. Feeding scars were apparent on old-growth, fully elongated needles; but live midge larvae were seldom found. A parasitic mite, Pyemotes emarginatus (Cross, Moser, Rack 1981), was abundant on old growth, but was less abundant on new growth. Pyemotes emarginatus was found associated with 13% of the infested fascicles on new growth. Results of larval sampling are summarized in table 2. Mean larval densities per needle fascicle for the 1, 2, 3, 4, and 5 inch segments were 14.74, 15.76, 15.27, 13.51, and 13.13, respectively.

One week after the first evaluation (September 1) approximately 77% of the fascicles within the new growth were infested. Each fascicle contained a mean of 2.51 larvae. Table 3 compares the larval densities for clones 18, 30, and 43 sampled during the first (August 23) and second (September 1) evaluations. During the first evaluation the live larvae were 17.95 times more abundant than the dead larvae. However, during the second evaluation the dead larvae outnumbered the live larvae. Pyemotes emarginatus were abundant during the second evaluation and probably were the major mortality agents. The increase in numbers of dead larvae from 0.81 to 3.79 per fascicle can be attributed partially to increasing parasitism by Pyemotes mites. However this increasing death rate accounts for only 25% of the changes in population densities between the first and second evaluation. Approximately 56% of the larval population found on August 23 was not present in the fascicles on September 1. Apparently many of the mature larvae had vacated the fascicles in search of pupation sites in the

Table 1. Rankings of clones (Texas loblolly seed sources) susceptible to damage of the pine needle midge, <u>Contarinia</u> sp. (Stuart Seed Orchard 1983).

| Rank | Clone | Ramets | % Ramets in Heavy Damage Class | Rank | Clone | Ramets | % Ramets in Heavy Damage Class |
|---|---|---|---|---|---|---|---|
| 1 | 10 | 16 | 100 | 23 | 19 | 13 | 69 |
| 2 | 27 | 15 | 100 | 24 | 47 | 16 | 69 |
| 3 | 30 | 13 | 100 | 25 | 3 | 14 | 64 |
| 4 | 46 | 14 | 100 | 26 | 17 | 25 | 64 |
| 5 | 25 | 19 | 95 | 27 | 23 | 11 | 64 |
| 6 | 34 | 16 | 94 | 28 | 6 | 16 | 63 |
| 7 | 18 | 10 | 90 | 29 | 16 | 13 | 62 |
| 8 | 29 | 17 | 88 | 30 | 21 | 19 | 58 |
| 9 | 31 | 16 | 88 | 31 | 44 | 9 | 56 |
| 10 | 40 | 17 | 88 | 32 | 38 | 8 | 50 |
| 11 | 2 | 14 | 86 | 33 | 5 | 13 | 46 |
| 12 | 22 | 14 | 86 | 34 | 39 | 22 | 45 |
| 13 | 33 | 13 | 85 | 35 | 28 | 18 | 44 |
| 14 | 26 | 12 | 83 | 36 | 12 | 14 | 43 |
| 15 | 35 | 12 | 83 | 37 | 24 | 12 | 42 |
| 16 | 20 | 11 | 82 | 38 | 48 | 17 | 41 |
| 17 | 36 | 21 | 81 | 30 | 41 | 12 | 33 |
| 18 | 32 | 13 | 77 | 40 | 45 | 19 | 32 |
| 19 | 42 | 20 | 75 | 41 | 37 | 17 | 29 |
| 20 | 11 | 15 | 73 | 42 | 15 | 19 | 26 |
| 21 | 43 | 18 | 72 | 43 | 1 | 21 | 10 |
| 22 | 49 | 10 | 70 | | | | |

Table 2. Mean numbers of pine needle midge larvae per fascicle found in segments of new growth (Stuart Seed Orchard 8/22, 8/23, 1983).

| Clone | Larvae per fascicle found on 1 inch segments[1] of new growth | | | | |
|---|---|---|---|---|---|
| | 1" | 2" | 3" | 4" | 5" |
| 5 $\bar{x}$[2] | 10.36 | 13.72 | 12.84 | 10.60 | 8.16 |
| R[3] | 0 - 30 | 1 - 39 | 1 - 37 | 1 - 27 | 0 - 18 |
| 18 $\bar{x}$ | 17.44 | 21.28 | 18.40 | 16.04 | 15.92 |
| R | 1 - 65 | 1 - 50 | 0 - 45 | 0 - 45 | 3 - 48 |
| 20 $\bar{x}$ | 18.20 | 17.15 | 17.90 | 18.85 | 16.10 |
| R | 0 - 48 | 0 - 55 | 0 - 47 | 1 - 48 | 1 - 46 |
| 30 $\bar{x}$ | 13.12 | 12.76 | 15.96 | 12.80 | 15.80 |
| R | 2 - 28 | 1 - 28 | 3 - 31 | 3 - 27 | 3 - 30 |
| 43 $\bar{x}$ | 14.56 | 13.88 | 11.24 | 9.24 | 9.68 |
| R | 1 - 41 | 1 - 61 | 1 - 31 | 0 - 27 | 0 - 33 |
| Mean | 14.74 | 15.76 | 15.27 | 13.51 | 13.13 |

[1] Inch segments; 1" = 1 inch below apical bud, 2" = between 1 and 2 inches below apical bud, 3" = between 2 and 3 inches below apical bud, 4" = between 3 and 4 inches below apical bud, 5" = between 4, and 5 inches below apical bud.

[2] $\bar{x}$ = Mean numbers of larvae per fascicle; N = 25 fascicles per segment.

[3] R = Range in larval counts per fascicle.

Table 3. Comparison of the live and dead larval densities during the first (August 23) and the second (September 1) evaluations (Stuart Seed Orchard, 1983).

| Clone | Mean number of larvae per fascicle | | | |
|---|---|---|---|---|
| | First evaluation | | Second evaluation | |
| | Alive | Dead | Alive | Dead |
| 18 | 17.82 | 1.34 | 2.48 | 3.96 |
| 30 | 14.09 | 0.63 | 1.43 | 2.59 |
| 43 | 11.72 | 0.46 | 3.61 | 4.83 |
| Mean | 14.54 | 0.81 | 2.51 | 3.79 |

litter under the tree canopy. On October 19 the infested blocks within the Texas loblolly seed source were re-examined. No midge larvae were found indicating that the late August generation is the overwintering generation.

## SUMMARY AND DISCUSSION

Apparently the needle midge, *Contarinia* sp., has multiple generations per year. At the Stuart Seed Orchard, feeding scars were apparent on all growth flushes. The larvae of the current generation are most prevalent in the new growth where they feed within the fascicle. Damage is not apparent until the needles elongate. Outbreaks have been documented during 1971-1974 at the Erambert Seed Orchard when Cygon® was applied as a drench spray at a rate of 4 pints of E.C. (2 lbs/gal) in 100 gal of water. The outbreak at the Stuart Seed Orchard occurred in 1983 when the orchard was sprayed aerially with Guthion® at a rate of 2 lbs of A.I./AC in 10 gals of water. Because of the protected feeding location, contact pesticides probably are not effective. It appears that this needle midge becomes a problem sporatically when contact insecticides kill predators and parasites, leaving the midge to grow within the needle fascicle. Systemic insecticides *may* be more effective for control operations.

In addition to the loss in tree vigor caused by midge defoliation, the potential exists for an influx of secondary insects, *Ips*, deodar weevils, etc. Dieback may be expected when defoliation is prolonged. Fungal isolates from dead tips on trees suffering severe midge damage at the Erambert Seed Orchard were identified as *Fusarium moniliforme*, the pitch canker causal agent. In Florida, infestations of a similar needle midge on slash pine are usually followed by pitch canker outbreaks (personal communications with Dr. John Foltz, Univ. of Florida, Gainesville, Florida).

Stuart Seed Orchard personnel and FPM are concerned about the potential consequences of additional midge defoliation and/or a pitch canker outbreak. If overwintering insect mortality is not excessive, adult midges should be abundant in the spring (1984). New growth flushes synchronized with larval emergence should provide adequate food source to support sizeable midge populations.

## RECOMMENDATIONS

1. Attempt to rear larvae to the adult stage for purposes of species identification and description.
2. Screen Orthene® (foliar systemic), Furadan® 4F, and Furadan 15G in Fall 1983 for efficacy against midge larvae.
3. Survey orchard in Spring 1984 as the first flush of growth is occurring for presence of midge larvae within needle fascicles.
4. Continue pitch canker survey in Texas and Louisiana loblolly seed sources.

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